REVISIONS			
LTR	DESCRIPTION	DATE (YR-MO-DA)	APPROVED
—	PRODUCT BASELINE ERR U1856	02-10-30	EB

NOTES:

1. APPLICABLE STANDARDS/SPECIFICATIONS:
   - A. MIL-STD-100F
   - B. SAE J1455

2. SCOPE AND CLASSIFICATION:

   2.1 SCOPE: THIS SPECIFICATION ESTABLISHES UNIFORM TEST METHODS FOR DETERMINING THE WATERPROOFNESS (RESISTANCE TO THE EFFECTS OF WATER) OF ELECTRICAL COMPONENTS OF AUTOMOTIVE VEHICLES.

   2.2 CLASSIFICATION: FOR THE PURPOSE OF THIS SPECIFICATION, COMPONENTS SHALL BE CLASSIFIED AS FOLLOWS:

   CLASS 1 – SEALED, SERVICEABLE
   CLASS 2 – SEALED, NON-SERVICEABLE

   2.3 TYPE OF TEST: FOR THE PURPOSE OF THIS SPECIFICATION, THE COMPONENT TEST METHOD REQUIREMENTS SHALL BE DEFINED AS FOLLOWS:

   TEST TYPE I – PRESSURE/VACUUM IMMERSION
   TEST TYPE II – THERMAL SHOCK IMMERSION
   TEST TYPE III – WATER JET SPRAY

   2.4 APPLICATION OF TEST METHODS: TEST METHODS CONTAINED IN THIS SPECIFICATION APPLY BROADLY TO AUTOMOTIVE ELECTRICAL COMPONENTS AND GENERALLY REPRESENT THE MINIMUM ACCEPTABLE CONDITIONS. WHEN IT IS KNOWN THAT THE COMPONENT WILL ENCOUNTER CONDITIONS MORE SEVERE OR LESS SEVERE THAN THE ENVIRONMENTAL LEVELS STATED HEREIN, THE TEST MAY BE MODIFIED BY THE COMPONENT SPECIFICATIONS INDICATED ON THE DETAIL DRAWING.

   2.5 METHOD OF REFERENCE: TEST METHODS DEFINED HEREIN SHALL BE REFERENCED BY SPECIFYING:

   - A. THIS SPECIFICATION NUMBER
   - B. CLASSIFICATION OF COMPONENT
   - C. TEST TYPE

3. REQUIREMENTS:

   3.1 UNLESS OTHERWISE SPECIFIED ON THE COMPONENT DRAWING, TESTS SHALL BE ACCOMPLISHED ON A FULLY ASSEMBLED COMPONENT. WHEN TEST CONDITIONS REQUIRE THAT THE COMPONENT BE CONNECTED IN AN ELECTRICAL CIRCUIT, ONLY INTERFACE CONNECTIONS DESIGNED TO MATE WITH THE TEST COMPONENT SHALL BE USED IN MAKING UP THE CIRCUIT.

REV STATUS OF SHEETS	REV	—	—	—	—												
	SHEET	1	2	3	4												

PMIC NA		CONTRACT NUMBER DAAE07-99-C-S027	U.S. ARMY TANK-AUTOMOTIVE COMMAND WARREN, MICHIGAN 48397-5000	
APPLICATION		CONTRACTOR AM GENERAL CORP. ENGINEERING & TECHNICAL SERVICES DIV. LIVONIA, MICHIGAN	WATERPROOFNESS REQUIREMENT FOR AUTOMOTIVE ELECTRICAL COMPONENTS	
NEXT ASSY	USED ON	DRAWN BY SMZ — DATE (YR-MO-DA) 02-10-29		
		CHECKER EB — ENGINEER D-29-02		
	HMMWV	DRAWING APPROVAL WGray 02-11-05	SIZE A — CAGE CODE 19207	12480561
	FOV			
MATL ENGR D.T.	W02/10/30	DESIGN APPROVAL 02-11-06	SCALE NONE — UNIT WT. —	SHEET 1 OF 4

3.1.1 TEST SAMPLE: THE NUMBER OF COMPONENTS TO BE SUBMITTED FOR WATERPROOF TESTING SHALL BE ONE UNLESS OTHERWISE SPECIFIED ON THE COMPONENT DRAWING. HOWEVER, A MINIMUM OF TWO COMPONENTS ARE REQUIRED IF THEY ARE NON-SERVICEABLE AND ARE REPLACED WHEN FAILURE OCCURS. THE TEST COMPONENT SHALL BE VISUALLY EXAMINED FOR CLEANLINESS OF ITS EXTERIOR SURFACES AND ALL FOREIGN MATTER SHALL BE REMOVED. WHEN REQUIRED, FOR SUBMERGED OPERATION, ALL CONNECTIONS SHALL BE COMPLETED, AND THE TEST CIRCUIT OPERATED PRIOR TO SUBMERSION.

3.1.2 TEST APPARATUS (FOR PRESSURE/VACUUM IMMERSION TEST): TESTS SHALL BE CONDUCTED IN A CHAMBER EQUIPPED WITH A VIEWING WINDOW THROUGH WHICH THE COMPONENT MAY BE OBSERVED THROUGHOUT THE TEST. THE CHAMBER SHALL BE EQUIPPED WITH SUITABLE SEALS, TERMINAL CONNECTIONS, GAUGES AND PUMPS TO PERMIT EITHER EVACUATION OR PRESSURIZATION OF THE CHAMBER AS REQUIRED. THE MINIMUM SIZE OF THE CHAMBER SHALL BE 100 PERCENT IN EXCESS OF THE TEST COMPONENT AND ITS RELATED HARDWARE.

3.1.3 SALINE SOLUTION: THE SALT USED SHALL BE SODIUM CHLORIDE CONTAINING, ON A DRY BASIS, NOT MORE THAN 0.1 PERCENT OF SODIUM IODIDE AND NOT MORE THAN 0.2 PERCENT OF TOTAL IMPURITIES. THE SOLUTION SHALL BE PREPARED BY DISSOLVING 5 PARTS BY WEIGHT OF SALT IN 95 PARTS BY WEIGHT OF DISTILLED WATER OR OTHER WATER CONTAINING NOT MORE THAN 200 PARTS PER MILLION OF TOTAL SOLIDS. THE SOLUTION SHALL BE KEPT FREE OF SEDIMENT OF FILTRATION OR DECANTATION.

3.1.4 PRE-TEST PERFORMANCE RECORD: PRIOR TO TESTING, COMPONENTS SHALL BE INSTALLED IN A TEST CIRCUIT EQUIVALENT TO THEIR NORMAL DRY ENVIRONMENT AND OPERATED BOTH MECHANICALLY AND ELECTRICALLY, AS APPLICABLE, FOR A PERIOD OF 30 MINUTES MINIMUM AT FULL-RATED CURRENT AND VOLTAGE. INTERMITTENT OPERATION COMPONENTS, UNLESS OTHERWISE SPECIFIED, SHALL BE OPERATED THREE TIMES FOR 30 SECONDS EACH. OPERATION SHALL BE WITH NO LOAD, AND FIVE-MINUTE INTERVALS SHALL BE ALLOWED BETWEEN EACH OPERATION. PERFORMANCE CHARACTERISTICS SHALL BE RECORDED.

3.1.5 FAILURE CRITERIA: THE FOLLOWING SHALL BE CONSIDERED AS EVIDENCE OF FAILURE:

3.1.5.1 TEST TYPE I, CLASS 1 AND 2 COMPONENTS:

A. AN INTERNAL LEAK AS EVIDENCED BY BUBBLES ESCAPING FROM THE INTERIOR OF THE COMPONENT. BUBBLES WHICH ARE THE RESULT OF ENTRAPPED AIR ON THE EXTERIOR SURFACES OF THE COMPONENT SHALL NOT BE CONSIDERED A LEAK.

B. THE PRESENCE OF WATER ON THE INTERIOR OF THE COMPONENT IN AREAS WHICH, BY DESIGN, WERE MEANT TO BE SEALED.

C. FAILURE TO OPERATE AT ANY TIME DURING OR POST-TEST. INSULATION BREAKDOWN OR OTHER DAMAGE THAT WOULD IMPAIR MECHANICAL OR ELECTRICAL OPERATIONS. A SUFFICIENT DIFFERENCE IN THE COMPARISON OF THE PRE-, DURING, AND POST-TEST DATA RECORDS.

3.1.5.2 TEST TYPE II AND III, CLASS 1 AND 2 COMPONENTS:

A. THE PRESENCE OF WATER ON THE INTERIOR OF THE COMPONENT IN AREAS WHICH, BY DESIGN, WERE MEANT TO BE SEALED.

B. FAILURE TO OPERATE AT ANY TIME AS SPECIFIED BY THE TEST PROCEDURE. INSULATION BREAKDOWN OR OTHER DAMAGE THAT WOULD IMPAIR MECHANICAL OR ELECTRICAL OPERATIONS. A SUFFICIENT DIFFERENCE IN THE COMPARISON OF THE PRE-, DURING, AND POST-TEST DATA RECORDS.

3.2 TEST PROCEDURE:

3.2.1 TEST TYPE I, PRESSURE/VACUUM IMMERSION: EACH COMPONENT, WITH ITS ELECTRICAL CONNECTIONS, SHALL BE SUBMERGED IN A CONTAINER WITH THE UPPERMOST SURFACE A MINIMUM OF ONE INCH BELOW THE SURFACE OF A SALINE SOLUTION AND INSTALLED IN THE CHAMBER. THE COMPONENT SHALL BE CAREFULLY OBSERVED DURING ITS ENTIRE PERIOD OF SUBMERSION AND SHALL BE OPERATED WHILE SUBMERGED FOR 30 MINUTES AT FULL-RATED CURRENT AND VOLTAGE OR THREE 30-SECOND OPERATIONS AT NINE AND ONE-HALF MINUTE INTERVALS FOR INTERMITTENT-DUTY COMPONENTS. THE CHAMBER SHALL BE EVACUATED TO A PRESSURE SIX POUNDS BELOW ATMOSPHERIC SO AS TO APPLY A MINIMUM OF SIX POUNDS PER SQUARE INCH (PSI) INTERNAL PRESSURE TO ALL VOIDS WITHIN THE COMPONENT. TEST RESULTS OBTAINED SHALL BE COMPARED WITH THE DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD (SEE 3.1.4). DURING THIS PERIOD, THE COMPONENT SHALL BE CAREFULLY OBSERVED FOR POOR SEALS AS EVIDENCED BY BUBBLES ESCAPING FROM THE INTERIOR OF THE COMPONENT.

THE CHAMBER SHALL THEN BE PRESSURIZED TO SIX POUNDS ABOVE ATMOSPHERIC AND THE COMPONENT AGAIN OPERATED SAME AS ABOVE.

3.2.1.1 POST-TEST EVALUATION. TEST RESULTS OBTAINED SHALL BE COMPARED WITH THE DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD (SEE 3.1.4).

3.2.1.1.1 CLASS 1. SERVICEABLE COMPONENTS ONLY SHALL BE DISASSEMBLED AS NORMALLY REQUIRED AND INSPECTION MADE FOR THE PRESENCE OF WATER. IF THE COMPONENT IS DRY, IT SHALL BE REASSEMBLED AND SUBJECTED TO 15 HOURS OF DRY OPERATION (THREE FIVE-HOUR PERIODS) AT FULL-RATED CURRENT AND VOLTAGE OR TEN 30-SECOND OPERATIONS AT NINE AND ONE-HALF MINUTE INTERVALS FOR INTERMITTENT DUTY COMPONENTS. THE RESULTS SHALL BE COMPARED WITH THE TEST DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD PRIOR TO INITIAL SUBMERSION.

3.2.1.1.2 CLASS 2. NON-SERVICEABLE COMPONENTS. ONE SAMPLE SHALL BE DESTRUCTIVELY OPENED, IF NECESSARY, TO INSPECT FOR THE PRESENCE OF WATER. THE SECOND SAMPLE SHALL BE SUBJECTED TO THE SAME DRY OPERATION DEFINED ABOVE. THE RESULTS SHALL BE COMPARED WITH THE TEST DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD.

3.2.2 TEST TYPE II, THERMAL SHOCK IMMERSION. EACH COMPONENT TESTED SHALL BE CAPABLE OF OPERATION DURING AND AFTER A TEMPERATURE IMMERSION TEST. WITH INTERFACE MATING ELECTRICAL CONNECTOR INSTALLED, THE COMPONENT SHALL RESIST WATER ENTRY, NONE ALLOWED, CAUSED BY INTERNAL PRESSURE CHANGE. THE SYSTEM COMPONENT SHALL BE HEAT SOAKED TO +200 °F (+93 °C)±10% FOR 2 HOURS MINIMUM. THEN IMMERSED IN A CONTAINER OF SALINE SOLUTION AT +65 °F (+18 °C) ±10% FOR 15 MINUTES MINIMUM.

3.2.2.1 POST-TEST EVALUATION. TEST RESULTS OBTAINED SHALL BE COMPARED WITH THE DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD (SEE 3.1.4).

3.2.2.1.1 CLASS 1. SERVICEABLE COMPONENTS ONLY SHALL BE DISASSEMBLED AS NORMALLY REQUIRED AND INSPECTION MADE FOR THE PRESENCE OF WATER. IF THE COMPONENT IS DRY, IT SHALL BE REASSEMBLED AND SUBJECTED TO ONE HOUR OF OPERATION OR TWO 30-SECOND OPERATIONS FOR INTERMITTENT-DUTY COMPONENTS. THE RESULTS SHALL BE COMPARED WITH THE TEST DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD PRIOR TO INITIAL SUBMERSION.

3.2.2.1.2 CLASS 2. NON-SERVICEABLE COMPONENTS. ONE SAMPLE SHALL BE DESTRUCTIVELY OPENED, IF NECESSARY, TO INSPECT FOR THE PRESENCE OF WATER. THE SECOND SAMPLE SHALL BE SUBJECTED TO THE SAME DRY OPERATION DEFINED ABOVE. THE RESULTS SHALL BE COMPARED WITH THE TEST DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD.

3.2.3 TEST TYPE III, WATER JET SPRAY. EACH COMPONENT TESTED SHALL BE CAPABLE OF NORMAL OPERATION FOLLOWING EXPOSURE TO THE PRESSURE WASH TEST DEFINED BY SAE J1455, PARAGRAPH 4.5, EXCEPT THE TEST APPARATUS SHALL PROVIDE A SOURCE PRESSURE OF 250 PSI ±10% WITH A FLOW RATE OF 150 GALLONS/HOUR ±10%. THE WATER TEMPERATURE SHALL BE AT A MINIMUM OF 170 °F (77 °C). THE TEST SAMPLE ROTATION SHALL BE 1.0 + / - .5 RPM.

3.2.3.1 POST-TEST EVALUATION. TEST RESULTS OBTAINED SHALL BE COMPARED WITH THE DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD (SEE 3.1.4).

3.2.3.1.1 CLASS 1. SERVICEABLE COMPONENTS ONLY SHALL BE DISASSEMBLED AS NORMALLY REQUIRED AND INSPECTION MADE FOR THE PRESENCE OF WATER. IF THE COMPONENT IS DRY, IT SHALL BE REASSEMBLED AND SUBJECTED TO ONE HOUR OF OPERATION OR TWO 30-SECOND OPERATIONS FOR INTERMITTENT-DUTY COMPONENTS. THE RESULTS SHALL BE COMPARED WITH THE TEST DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD PRIOR TO INITIAL SUBMERSION.

3.2.3.1.2 CLASS 2. NON-SERVICEABLE COMPONENTS. ONE SAMPLE SHALL BE DESTRUCTIVELY OPENED, IF NECESSARY, TO INSPECT FOR THE PRESENCE OF WATER. THE SECOND SAMPLE SHALL BE SUBJECTED TO THE SAME DRY OPERATION DEFINED ABOVE. THE RESULTS SHALL BE COMPARED WITH THE TEST DATA OBTAINED FROM THE PRE-TEST PERFORMANCE RECORD.